

CLAIMS

1. A chemical liquid injector for injecting a chemical liquid from a liquid syringe including a cylinder member and a piston member slidably inserted into the cylinder member into a patient through an extension tube, comprising:

a cylinder holding mechanism for removably holding a cylinder member of a liquid syringe;

a piston driving mechanism for moving a piston member relative to the held cylinder member;

a wave emitting element for emitting a wave to a predetermined position on an outer surface of the held cylinder member at a predetermined angle;

a wave detecting element for detecting the intensity of the wave at a predetermined position on the outer surface of the held cylinder member;

abnormality determining means for determining occurrence of abnormality when the detected intensity of the wave does not comply with a predetermined allowable range; and

alarm notifying means for outputting a check alarm when the occurrence of abnormality is determined.

2. A chemical liquid injector for injecting a chemical liquid from a liquid syringe including a cylinder member and a piston member slidably inserted into the cylinder member into a patient through an extension tube, comprising:

a cylinder holding mechanism for removably holding a cylinder

member of a liquid syringe;

a piston driving mechanism for moving a piston member relative to the held cylinder member;

a wave emitting element for emitting a wave to a predetermined position on an outer surface of an extension tube;

a wave detecting element for detecting the intensity of the wave at a predetermined position on the outer surface of the extension tube;

abnormality determining means for determining occurrence of abnormality when the detected intensity of the wave does not comply with a predetermined allowable range; and

alarm notifying means for outputting a check alarm when the occurrence of abnormality is determined.

3. A chemical liquid injector for injecting a chemical liquid from a liquid syringe including a cylinder member and a piston member slidably inserted into the cylinder member into a patient through an extension tube, comprising:

a cylinder holding mechanism for removably holding a cylinder member of a liquid syringe;

a piston driving mechanism for moving a piston member relative to the held cylinder member;

a wave emitting element for emitting a wave to a predetermined position on an outer surface of the held cylinder member at a predetermined angle;

a wave detecting element for detecting the wave at a predetermined position on the outer surface of the held cylinder member;

time measuring means for measuring a time period from the emission to the detection of the wave;

abnormality determining means for determining occurrence of abnormality when the measured time period does not comply with a predetermined allowable range; and

alarm notifying means for outputting a check alarm when the occurrence of abnormality is determined.

4. A chemical liquid injector for injecting a chemical liquid from a liquid syringe including a cylinder member and a piston member slidably inserted into the cylinder member into a patient through an extension tube, comprising:

a cylinder holding mechanism for removably holding a cylinder member of a liquid syringe;

a piston driving mechanism for moving a piston member relative to the held cylinder member;

a wave emitting element for emitting a wave to a predetermined position on an outer surface of an extension tube at a predetermined angle;

a wave detecting element for detecting the wave at a predetermined position on the outer surface of the extension tube;

time measuring means for measuring a time period from the emission to the detection of the wave;

abnormality determining means for determining occurrence of abnormality when the measured time period does not comply with a predetermined allowable range; and

alarm notifying means for outputting a check alarm when the

occurrence of abnormality is determined.

5. A chemical liquid injector according to any one of claims 1 to 4, wherein said wave emitting element emits light beam as the wave, and said wave detecting element detects light beam as the wave.

6. A chemical liquid injector according to any one of claims 1 to 4, wherein said wave emitting element emits an ultrasonic wave as the wave, and said wave detecting element detects an ultrasonic wave as the wave.

7. A chemical liquid injector for injecting a chemical liquid from a liquid syringe including a cylinder member and a piston member slidably inserted into the cylinder member into a patient through an extension tube, comprising:

a cylinder holding mechanism for removably holding a cylinder member of a liquid syringe;

a piston driving mechanism for moving a piston member relative to the held cylinder member;

a wave emitting element for emitting light beam to a predetermined position on an outer surface of the held cylinder member at a predetermined angle;

a wave detecting element for detecting the light beam at a predetermined position on the outer surface of the held cylinder member;

abnormality determining means for determining occurrence of abnormality when the light beam is detected; and

alarm notifying means for outputting a check alarm when the occurrence of abnormality is determined.

8. A chemical liquid injector for injecting a chemical liquid from a liquid syringe including a cylinder member and a piston member slidably inserted into the cylinder member into a patient through an extension tube, comprising:

a cylinder holding mechanism for removably holding a cylinder member of a liquid syringe;

a piston driving mechanism for moving a piston member relative to the held cylinder member;

a wave emitting element for emitting light beam to a predetermined position on an outer surface of a extension tube at a predetermined angle;

a wave detecting element for detecting the light beam at a predetermined position on the outer surface of the extension tube;

abnormality determining means for determining occurrence of abnormality when the light beam is detected; and

alarm notifying means for outputting a check alarm when the occurrence of abnormality is determined.

9. A chemical liquid injector for injecting a chemical liquid from a liquid syringe including a cylinder member and a piston member slidably inserted into the cylinder member into a patient through an extension tube, comprising:

a cylinder holding mechanism for removably holding a cylinder member of a liquid syringe;

a piston driving mechanism for moving a piston member relative to the held cylinder member;

a wave emitting element for emitting an ultrasonic wave to a predetermined position on an outer surface of the held cylinder member at a predetermined angle;

a wave detecting element for detecting the ultrasonic wave at a predetermined position on the outer surface of the held cylinder member;

characteristic analyzing means for analyzing a resonance characteristic of the detected ultrasonic wave;

abnormality determining means for determining occurrence of abnormality from the analyzed resonance characteristic; and

alarm notifying means for outputting a check alarm when the occurrence of abnormality is determined.

10. A chemical liquid injector for injecting a chemical liquid from a liquid syringe including a cylinder member and a piston member slidably inserted into the cylinder member into a patient through an extension tube, comprising:

a cylinder holding mechanism for removably holding a cylinder member of a liquid syringe;

a piston driving mechanism for moving a piston member relative to the held cylinder member;

a wave emitting element for emitting an ultrasonic wave to a predetermined position on an outer surface of an extension tube at a predetermined angle;

a wave detecting element for detecting the ultrasonic wave at a

predetermined position on the outer surface of the extension tube;

characteristic analyzing means for analyzing a resonance characteristic of the detected ultrasonic wave;

abnormality determining means for determining occurrence of abnormality from the analyzed resonance characteristic; and

alarm notifying means for outputting a check alarm when the occurrence of abnormality is determined.

11. A chemical liquid injector according to claim 9 or 10, further comprising:

liquid determining means for the type of the liquid from the analyzed resonance characteristic; and

liquid outputting means for outputting the determined type of the liquid.

12. A chemical liquid injector according to any one of claims 9 to 11, further comprising:

liquid determining means for the type of the liquid from the analyzed resonance characteristic; and

injection control means for controlling the operation of the piston driving mechanism based on the determined type of the liquid.

13. A chemical liquid injector for injecting a chemical liquid from a liquid syringe including a cylinder member and a piston member slidably inserted into the cylinder member into a patient through an extension tube, comprising:

a cylinder holding mechanism for removably holding a cylinder member of a liquid syringe;

a piston driving mechanism for moving a piston member relative to the held cylinder member;

a capacitance detecting sensor for detecting a capacitance on an outer surface of the held cylinder member;

abnormality determining means for determining occurrence of abnormality when the detected capacitance does not comply with a predetermined allowable range; and

alarm notifying means for outputting a check alarm when the occurrence of abnormality is determined.

14. A chemical liquid injector for injecting a chemical liquid from a liquid syringe including a cylinder member and a piston member slidably inserted into the cylinder member into a patient through an extension tube, comprising:

a cylinder holding mechanism for removably holding a cylinder member of a liquid syringe;

a piston driving mechanism for moving a piston member relative to the held cylinder member;

a capacitance detecting sensor for detecting a capacitance on an outer surface of an extension tube;

abnormality determining means for determining occurrence of abnormality when the detected capacitance does not comply with a predetermined allowable range; and

alarm notifying means for outputting a check alarm when the

occurrence of abnormality is determined.

15. A chemical liquid injector according to any one of claims 1, 3, 7, 9, and 13, wherein the liquid syringe includes a plurality of types different from each other in at least one of the cylinder member and the liquid,

the chemical liquid injector further comprising type inputting means for inputting data of at least the type of the liquid syringe,

wherein the abnormality determining means determines the occurrence of abnormality based on the type.

16. A chemical liquid injector according to any one of claims 1, 3, 7, and 9, wherein the liquid syringe includes a plurality of types different from each other in the outer diameter of the cylinder member,

the chemical liquid injector further comprising component placing mechanism for movably supporting said wave emitting element and said wave detecting element to place them on the outer surface of the cylinder member.

17. A chemical liquid injector according to claim 16, wherein said component placing mechanism places at least one of said wave emitting element and said wave detecting element on the outer surface of an upper portion of the cylinder member.

18. A chemical liquid injector according to claim 16, wherein said component placing mechanism places at least one of said wave emitting element and said wave detecting element on the outer surface of a lower portion of the cylinder member.

19. A chemical liquid injector according to any one of claims 16 to 18, wherein said component placing mechanism places said wave emitting element and said wave detecting element near the leading end of the cylinder member.

20. A chemical liquid injector according to 13, wherein the liquid syringe includes a plurality of types different from each other in the outer diameter of the cylinder member,

the chemical liquid injector further comprising a component placing mechanism for movably supporting said capacitance detecting sensor to place it on the outer surface of the cylinder member.

21. A chemical liquid injector according to any one of claims 1 to 20, further comprising a drive stopping means for forcibly stopping said piston driving mechanism when the occurrence of abnormality is determined.

22. A chemical liquid injector according to any one of claims 1 to 21, further comprising a stop outputting means for outputting a stop signal to the outside when the occurrence of abnormality is determined.

23. A chemical liquid injecting system for imaging an image of a patient by a diagnostic imaging apparatus, the patient being injected with at least a contrast media by a chemical liquid injector, comprising:

a chemical liquid injector according to claim 22,

wherein a diagnostic imaging apparatus comprises imaging means for

taking an image, stop inputting means for receiving the stop signal from said chemical liquid injector, and alarm outputting means for outputting a check alarm when the stop signal is input thereto from the outside.

24. A chemical liquid injecting system according to claim 23, wherein said diagnostic imaging apparatus further comprises imaging stopping means for forcedly stopping the imaging operation of the imaging means when the stop signal is input thereto from the outside.